



Following is the information on projects to be done for Image Classification using Qiskit, TensorFlow and PennyLane in Quantum Machine Learning:

1. We have created a repository called – *Projects* in the *Master* repository.

| Name | Last commit | Last update |
|---|---|-------------|
|  Projects | Upload New File - CIFAR10_PennyLane.ipynb | 3 hours ago |
|  README.md | Update README.md | 2 weeks ago |

2. We are planning to do Image Classification using the following technology in Quantum Machine Learning:




2.1. Qiskit

2.2. TensorFlow and





2.3. PennyLane

3. We will form three (3) teams, One for each project

4. The *Projects* repository contains three (3) repositories as follows:

| Name | Last commit | Last update |
|---|---|-------------|
| .. | | |
|  1. Qiskit | Upload New File - CIFAR10_Qiskit.ipynb | 8 hours ago |
|  2. TensorFlow | Upload New File - MNIST_TensorFlow.ipynb | 8 hours ago |
|  3. PennyLane | Upload New File - CIFAR10_PennyLane.ipynb | 8 hours ago |

5. Each of the above repositories contains the following:

| Name | Last commit | Last update |
|---|--|--------------|
| .. | | |
|  0. Project Notebook | Upload New File - CIFAR10_Qiskit.ipynb | 9 hours ago |
|  1. Reference Material | Upload New File - MNIST_Qiskit.ipynb | 9 hours ago |
|  .gitkeep | Add new directory | 10 hours ago |
|  README.md | Add new file | 9 hours ago |

5.1. README.md: This contains information about setting up an environment for coding. We are going to use *Google Colab* (<https://colab.research.google.com/>) for coding. So, nothing is required to be installed on your local computer. You just need *Google Account* for using *Google Colab*.

5.2.0. Project Notebook: This repository contains a notebook *CIFAR10_<TechnologyName>.ipynb*, e.g., *CIFAR10_Qiskit.ipynb*, in which you need to

do your code. We are going to use the open-source dataset CIFAR10. The notebook contains few lines of codes, e.g., importing necessary libraries and code for downloading the dataset.

The screenshot shows a GitHub repository page for '19_qml-for-image-processing'. The breadcrumb navigation indicates the path: '19_qml-for-image-processing / Projects / 1. Qiskit / 0. Project Notebook /'. A file named 'CIFAR10_Qiskit.ipynb' is highlighted with a red box in the file list. The file was uploaded by 'Viratkumar Kothari' 9 hours ago. Below the file list, a 'README.md' file is shown with a description: 'This directory contains CIFAR10_Qiskit.npyb file. This is your project file and you need to do your code in it.'

| Name | Last commit | Last update |
|-----------------------------|--|--------------|
| .. | | |
| .gitkeep | Add new directory | 10 hours ago |
| CIFAR10_Qiskit.ipynb | Upload New File - CIFAR10_Qiskit.ipynb | 9 hours ago |
| README.md | Add new file | 10 hours ago |

You need to download this notebook, upload it on *Google Colab* to start coding. We are going to use Python as our coding language.




The screenshot shows the Google Colaboratory interface. A file upload dialog is open, displaying tabs for 'Examples', 'Recent', 'Google Drive', 'GitHub', and 'Upload'. The 'Upload' tab is selected. Inside the dialog, there is a 'Browse...' button and the text 'No file selected.' The background shows the Colaboratory workspace with a 'Table of contents' on the left and a code editor area.

5.3.1. Reference Material: This repository contains reference material for respective technology, e.g. *Qiskit* folder will have reference material related and notebook related to *Qiskit*. The folder contains:

5.3.1. README.md: This contains a list of various reading materials that may help you to understand the technology.

| README.md |
|--|
| <p>QML for Image Processing</p> <p>Following are few links that may be helpful to understand the Quantum Machine Learning concepts. This also includes few links of similar sample problem which may be useful to solve our image classification problem:</p> <ol style="list-style-type: none"> 1. https://qiskit.org/documentation/machine-learning/index.html?highlight=quantum%20machine%20learning 2. https://qiskit.org/documentation/machine-learning/tutorials/05_torch_connector.html#Part-2:-MNIST-Classification 3. https://qiskit.org/documentation/machine-learning/tutorials/05_torch_connector.html#Part-1:-Simple-Classification-&-Regression <p>Quantum Transfer Learning:</p> <ol style="list-style-type: none"> 1. PennyLane: https://pennylane.ai/qml/demos/tutorial_quantum_transfer_learning.html |

5.3.2. A Notebook: A notebook named *MNSIT_<TechnologyName>.ipynb* e.g., MNIST_Qiskit.ipynb. It is the example/tutorial for Image Classification using Quantum Machine Learning with MNIST dataset. It is the best sample to understand the code step-by-step.

| Name | Last commit | Last update |
|--|--------------------------------------|--------------|
| .. | | |
|  .gitkeep | Add new directory | 10 hours ago |
|  MNIST_Qiskit.ipynb | Upload New File - MNIST_Qiskit.ipynb | 9 hours ago |
|  README.md | Add new file | 10 hours ago |

Note:

1. We will provide information on how to commit your project notebook in the central repository separately.
2. Please do *NOT* upload anything by yourself; please ask us to do so. It will help to maintain code in order.

We hope that the above information is enough and will help you guide the project repository structure.

Best wishes!!